Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	WT Docket No. 01-309
Section 68.4(a) of the Commission's Rules	)	RM-8658
Governing Hearing Aid-Compatible Telephones	)	

Reply Comments of:

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In reading comments from others, it is apparent that some have skirted around the meaning of HAC. For example, some commenters reported that only 20 % of hearing aids have telecoils, and that statistic was in the NPRM. They also pointed out that the digital cell phone interference problem affects hearing aid users who do not have telecoils. That may be true, but it is beyond the scope of this NPRM, and interference to those users is not nearly as severe. I agree with those commenters that those hearing aid users should be able to use digital cell phones too, and many of them can, just by placing the cell phone speaker close to the hearing aid microphone.

There may be more hearing aids equipped with telecoils than 20%, but even if there is not, it is those 20% that are affected by this ruling. That is because the definition of HAC means a phone will emit electromagnetic signals that a telecoil can receive. A volume control was added to the definition later. Hearing aid users that have telecoils are the one who need telecoils the most. We have found a telecoil give us access to other kinds of telephones and a vast array of assistive listening devices. Our hearing loss is severe and of such a nature that a telecoil is needed. Almost all of TIA's comments and other industry comments focused on the other 80 percent - the users who do not have telecoils.

If the FCC, or others, wants to revisit the definition of HAC, that may be a good idea, but my comments, and comments from some others stayed within the definition of HAC. I would be very pleased if some day another medium is incorporated into hearing aids such as FM, Bluetooth, or IR, and the telecoil feature became obsolete. That is not likely to happen anytime soon and the telecoil is the only solution for those of us who need it.

I showed with oscilloscope traces that the interference from digital cell phones that cause trouble for telecoil users is in the audio frequency (AF) band. AF is generally considered to be from 20 HZ to 20,000 Hz, and RF is above 20,000 Hz to the light frequencies. RF emissions have little to do with the problem. Hearing aids are not designed to receive RF signals. Some do receive to a little extent, unintentionally. In other words, they are not very sensitive to RF signals. On the

other hand, a hearing aid in telecoil mode is designed to be very sensitive to electromagnetic radiation in the AF band. That is what the telecoil is designed for.

Commenters pointed out that all RF emissions are carefully monitored and must be on their assigned frequency. Out of band emissions are not allowed. We all know that, and it is one reason for the existence of the FCC. There does not seem to be any regard for out of band emissions in the AF range, and that is what this proceeding is addressing, although it has not been stated that way. The NPRM is addressing making digital cell phones HAC, which only concerns placing an effective transmitting coil inside the handset, and providing a volume control. Eliminating or reducing AF electromagnetic interference (EMI) is the unstated part. Except for hearing aids, and perhaps a few other electronic devices, EMI in the AF band is not a big problem in the sense of traveling far. Out of band RF does travel cross country, but out of band AF only travels a few feet.

The interference signal is a 50 Hz signal for some phones, depending on the network they are on, and about 250 Hz for some other networks. That is in the range that a telecoil is supposed to receive. The battery of a cell phone is a large radiator for AF signals. That is because of it's physical size and because the electronics of the phone is drawing power from the battery at the rates given above. The same interference would occur if one connected a large blinking light bulb to a cell phone battery. Each time the light turns on, power is drawn from the battery and a magnetic filed is formed around the battery and connecting wires. When the light goes off, the magnetic field collapses, and that building and collapsing of the magnetic field generates an electromagnetic signal that can be received, or has to be received by a working telecoil. A light bulb gives a good visual analogy, but it is not a good practical example because its turn on rate is much slower than the electronics of a cell phone.

The solution is to design the battery so electromagnetic radiation does not escape. This may be done by routing the physical paths to produce a cancellation or by enclosing the battery in a metal shield, or use both methods. Other parts inside the cell phone that carry high battery current may need shielding too.

My formula for making digital cell phones HAC is:

1. Enclose the battery and associated circuits in an effective AF radiation shield and/or use physical routing to achieve cancellation.

2. Include a large and effective transmitting coil inside the handset and drive it with sufficient audio power to generate a strong electromagnetic speech signal, a signal much stronger that any interference signals that may still be present. This will allow hearing aid users to keep the gain down on their hearing aids, thereby reducing any interference due to AF or RF. As I noted above, the AF is the biggest problem when in telecoil mode.